



Situational Analysis: Gerontechnology and Older Persons Wellbeing in developing countries

Abhishek Shivanand Lachyan^{1*} Wong Ming Fui², Bratati Banerjee³, Rafdzah Ahmad Zaki⁴

Department of Social and Preventive Medicine, Faculty of Medicine, University Malaya, Kuala Lumpur^{1,2}

Department Of Community Medicine Maulana Azad Medical College- New Delhi³

Department of Social and Preventive Medicine, Faculty of Medicine, University Malaya (UM), 50603, Kuala Lumpur, Malaysia⁴

ABSTRACT

The world is ageing increasingly, and developing countries are facing unprecedented growth. With the concurrent rapid growth in emerging digital technology, it provides a flourishing platform for Gerontechnology. The utilization of technology for healthcare realignment is part of the solution under Global Strategy on Ageing and Health to support healthy ageing. Substantial evidence from developed countries has shown positive effects of various gerontechnologies on the wellbeing of the older persons. However, little is known in developing countries. Materials and methods: The importance gained from the interaction between ICTs and older adults observed in studies, takes us a further step to review the pieces of literature to explore the acceptance and the impact of gerontechnology on the wellbeing among older persons. This rapid review was driven by the five phases of the Evidence-informed Decision-making (EIDM) methods and eleven papers were included for final extraction of the data. Result: Results showed that acceptance is low in countries like South Africa but high in Malaysia, where the accessibility is high. The popular devices are mobile phones, smartphones and computers. Case study revealed 35.5% of the participants who owned ICT devices are having chronic illness, and this sheds lights on the high accessibility of the device among the older persons who have co-morbidity. Discussion: Building on this report and scarcity of quality research in this field, especially in the developing, confer the need for a larger future studies with a robust methodology. Conclusion: Another aspect is to give full support to efforts to make gerontechnology accessible to older Indian or Malaysian and within reach. The government will set in effect strategies to allow older citizens to utilize technology, and promote a positive climate that will make them utilize gerontechnology.

Keywords: Gerontechnology, Older, Wellbeing, Developing Countries.

***Corresponding Author**

Dr. Abhishek Shivanand Lachyan

Department of Social and Preventive Medicine, Faculty of Medicine, University Malaya, Kuala Lumpur



© Copy Right, IJAHS, 2020. All Rights Reserved

INTRODUCTION

“Graying” population is a global phenomenon. As predicted by experts, the number of people older than 65 years old will soon be higher than those under five years old [1]. The rate of growth of this population is rather rapid at an unprecedented pace in this century, particularly in developing countries. Based on the data from the United Nations, the percentage of older persons in the region’s least developed countries in Asia Pacific countries has been estimated at 7.9 per cent in 2020, which is projected to increase to 18.3 per cent by

2050 [2]. This can be explained by the demographic transition, which was attributed to the overall better healthcare system and management, which has reduced premature death in developing countries [3].

No doubt, longevity offer opportunity for older persons to flourish, productive as a contribution to society. However, the older adult in this century is challenged by more health issues comparing with the previous generation. Rapid globalization and urbanization have led to socio-structural change leading to rising of non-communicable disease in the population [4]. In addition, migration of the younger generation to the urban for better job opportunity leads to role changing; children no more co-reside with parents as a family caregiver. United Nations has reported, older persons from developed countries tend to be lonelier as compared to developing countries. In Asia, Africa and Latin America and the Caribbean, well over half of the persons aged 60 or over co-resided with a child, by contrast, in Europe and in Northern America only around 20 per cent of older persons co-resided with their children [2]. Therefore, ageing is simply not physiological and biological per se. The collective effects in the population context, has its long-haul impact on the social, economic growth and healthcare management [5].

Ageing is taking place alongside other social determinants, and its remarkable implication on the sustainable development, a Global strategy on ageing and health has been framed to support the demographic changes on the ageing population. Under Sustainable Development Goals (SDGs) ageing healthily is our older person's aspiration. *Healthy Ageing* is the process of developing and maintaining 2 domains in functional ability (**Intrinsic capacity and environment**), that enables well-being in older age **Figure 1**[6]. This means preserving both physical and mental capacity (**Intrinsic capacity**) as the person advances in age - it also means making changes to the**environment** (housing, transportation, public spaces etc.) so that they are accessible to meet varying needs and capacities of the older people. This is also a right based approach, where the actions tackle inequities and ensure older people age safely in a place that is right for them, free from poverty, fostering self-development and communities participation while retaining autonomy and health.[7]

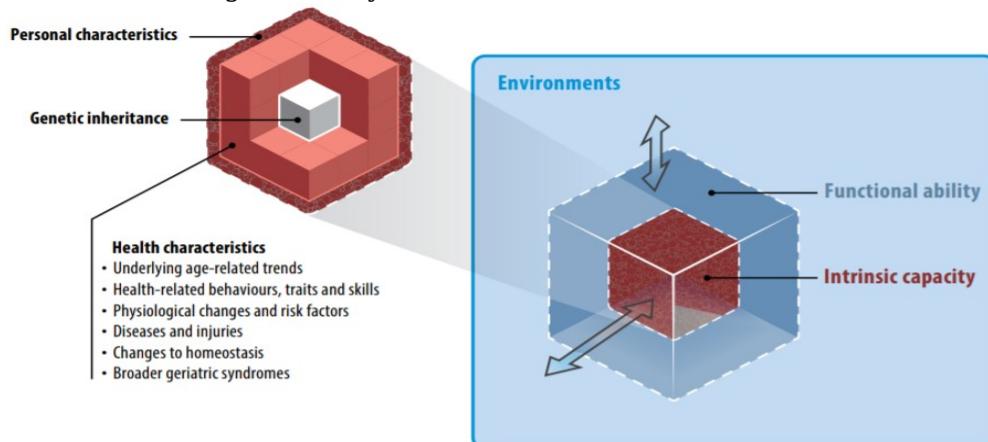


Figure 1: Healthy Ageing - Functional ability is depending on the intrinsic factors and environments factors. Adaptation from world report on Ageing and Health [6]

In a developed country, major health financing for the older persons comes from the government, contrary to developing countries where the family is the source of financial support and long term care solution. Changes in the family structure have compromised care for them. With such decline in support, the society requires better information and tools to ensure well-being of the older persons [4].

The Global strategy and action plan on ageing and health (2016-2020) has undertaking five keys objectives targeted on enhancing the intrinsic and environmental factors for healthy ageing. Two keys objectives have succinctly stating recommendation on utilization of technology in realigning the healthcare delivery and to promote a friendly environment that support healthy ageing **Figure 2**[8], [9].



FIGURE 2: Strategic Objectives- for no. 2 and no. 3 have recommendation on the usage of technology in enhancing the wellbeing of older persons.

Gerontechnology is a cross fertilization of its theoretical base ,formed by combining the two disciplines of gerontology (scientific study of aging) and technology (engineering sciences). Two similar terms “gerontechnology” and “gerotechnology” had been proposed in the beginning. Charness 2004 has argued elsewhere that “gerontechnology,” whose roots suggest technology concerned with aging, rather than “gerotechnology,” which suggests technology that is aging, is the more appropriate term to be used [10]. According to Bronswijk et al generally Gerontechnology is defined as a technology domain that links existing and developing technologies to the aspirations and needs of aging persons. It promotes social sustainability as it is concerned with technologically-based products, services, and environments that improve the **functioning and quality of life**[7].

Generally the research done globally for Gerontechnology has focused at various domains to improve the quality of life of the older person’s population. Among the 4 main areas are (i) health and self-esteem, housing and daily life, mobility and transport, communication and management, work and leisure; (ii) attitudes and experiences of older people towards the use of gerontological technologies and the identification of causes that may form the basis for their use or rejection (iii) technology analysis for four categories of older people's needs: social, medical, activeness and safety (iv) the impact of gerontology on the physical, mental health and social functions of its users [11]. There is considerable breadth in the types of technology discussed, ranging from relatively low-tech (kitchen utensils) to high-tech (robotics) products used within macro and micro environments. Attention is given to issues in designing for those undergoing “normal” to “pathological” (dementia) aging [10], [12].

Research into maintaining the physical and the pscychological domains represent one of the most heavily researched areas in gerontechnology[13]. Multiple reviews have done in developed countries in order to explore how remote monitoring, telecommunication strategies, and disease management technologies exert a positive impact in non-communicable diseases namely hypertension, diabetes, heart failure, chronic obstructive pulmonary and other psychiatric conditions [14],[15],[13], [14].

Development of information and communication technologies (ICTs) and demographic ageing have been two major social developments since the second half of the 1990s. This emerging platform is driven firstly by the accelerated growth of older persons share in the population and secondly rapid progression of communication domains in technological environment. Since 1990, communication and networking technology include the internet, e-mail, search engines on the web, mobile phones, Global Positioning System (GPS) and navigation tools, digital cameras, e-games, robots, menu-driven washing machines, and other systems, which have begun toinfluence the lives of older persons, in terms of social, mental and physical well-being [7].

There is presence of gaps of development of gerontechnology observed in developed countries compared to developing countries. This is directly linked to the level of development and the availability of policies that support the technology infrastructure. Countries like Malaysia and India have emphasized on ICT due to the national development policies to grow the ICT infrastructure. ICT has provided a potential platform for growth of gerontechnology, which is a cost-effective technology for countries like United States [14].

To date, most of the research on Gerontechnology has been dominated by the developed countries which explained the technology development driven by the adequacy of financial resources. Netherlands and United States top the list of countries promoting research and gerontechnologic developments worldwide [12].

In view of the growing and unsustainable costs of caring for the elderly people and the scarcity of the gerontechnology research in developing countries, a research question and related objectives have been stated below to frame an overview of the types of gerontechnology that are acceptable to the developing countries and its impact on the quality of life. This review contributes to the body of evidence, the range of gerontechnology that is acceptable, feasible and cost effective to improve the wellbeing in developing countries [11].

Research Question:

Is Gerontechnology able to enhance wellbeing of older adults in developing countries?

Objectives

1. To determine the range of utilization of types of gerontechnology and its determinants on acceptability in developing countries
2. To understand the barriers and facilitators associated with the acceptance of Gerontechnology
3. To assess the impact of Gerontechnology on the domains of quality of life namely physical, psychological, social or environmental domains
4. To conduct an online survey to explore the current technology usage among older adults in India and Malaysia

METHODOLOGY

The rapid review was guided by five steps of Evidence-informed decision making (EIDM) approach recommended by Dr. Dobbin, Rapid Review Guidebook Steps for conducting a rapid review. Health Evidence™ tool was utilized for 1) searching for and access relevant research evidence; 2) appraising the methodological quality of research evidence; 3) synthesizing the evidence.

Search Strategies

The following key search terms were defined based on the rapid review research questions and a combination of different research domains namely gerontechnology, elderly quality of life and developing countries. Search terms have been expanded by keywords and synonyms of gerontechnology; technology for elderly; technology for older people; technology for older adults; quality of life; wellbeing; developing countries and Asia. To improve the quality and unbiasedness of the search, wildcards have been used.

The final search string is as below:

(“gerontechnology” OR “technology for elderly” OR “technology for older person” OR “technology for older adults”) and (“quality of life” OR “wellbeing”) and (“Developing countries” OR “Asia countries”)(Appendix 1)

Four databases namely **Scopus**, **Google Scholar**, **PubMed** and **Cochrane library** have been adopted for systematic search of publication. **Scopus**, **PubMed** and **Cochrane library** offered a good coverage of peer-reviewed articles, while **Google Scholar** has been included to have a broader coverage of the grey literature in view of the scarcity of publication in gerontechnology. The literature search was also supplemented with a snowball searching to pursue references of reference involving the review papers.

Eligibility criteria

Literature search covered all gerontechnology articles, theses and review papers published before May2020, studies conducted in developing countries based on the World Bank checklist(**Appendix 2**)and was restricted to English language publications. Lower age limit of the target population has been capped at 55 years old in order to include more articles for data synthesis. This review also included studies in theses in view of scarcity of the evidence in this field.

Publications that describe the development of the conceptual framework of gerontechnology, policy development, and determinants of the usage, issues and challenges of using gerontechnology have been excluded from data extraction.

Data Extraction

Two independent reviewers from the public health fraternity have been involved in reviewing the articles to ensure the non-bias of the selection. Both reviewers have reached eighty per cent in agreement on the finalized list of articles for further data extraction (**Appendix3: Agreement on the Relevance of Articles**)

Given the limited publication and diversity in the methodology as studies were done by various field experts namely mechanical engineering, environmental study, clinical, public health, psychology, and computer sciences and ICT, assessment of the quality of the publications are based on any domain in quality of life. The grading of the quality was based on Level of Evidence.

Case Study

In view of the **Movement Control Order (MCO)** by the Government of Malaysia amid COVID-19, an online survey via Google form was conducted to gauge the baseline information of gerontechnology usage among the community of Malaysia and India. This online survey targeted participant 50 years old and above. A convenient sampling followed by snowball sampling methods was used to obtain the study participants. A Google form link was created and shared through **WhatsApp** to the students of University of Malaya, to reach out for their parents for participation. The study was conducted from the 6thto 8th April 2020. No similar study conducted in these two countries could be found and therefore sample size is based on feasibility for quantitative study with minimum required sample size of 30 to 59 participants [16]; [17].

Inclusion criteria were participants 50 years and above from two countries: Malaysia and India that agreed to participate in this study. Exclusion criteria were having cognitive dysfunction in the case of late stage of Dementia and co-morbid psychiatric illness[16].

A standardized questionnaire was developed based on the literature review and cultural background of the population that were intended for this study. There were 14 items in the questionnaire which were divided to two sections: Participants profiles and the baseline info on the gerontechnology usage. Participants' section captured the age, sex, ethnicity, occupation, any retirement savings and history of chronic illness. As for the baseline information on the gerontechnology usage of the common communication technology such as the types of communication devices they are using, how often, priority of owning a telecommunication device. This section ended with an open ended question on their opinion of using gerontechnology [18].

The original questionnaires were developed in English language and were translated to Malay and Mandarin languages to cater for participants that were not well verse in English language (**Appendix 5: Questionnaires in different Languages**).

A total of eleven participants from Malaysia and twenty participants from India were successfully recruited for this online study. Descriptive analysis was done by using SPSS version 25.0 software. A thematic analysis has been done for the last item in the survey

questionnaires. Coding has been done manually in Microsoft excel sheets (**Appendix4: Thematic Analysis**).

Results of the literature search

After the preliminary screening process, non-relevant articles were screened based on non-English language, title, abstract and chapter of a book, a total of 317 articles have been reduced to potentially relevant articles of 137 articles. Based on the inclusion criteria, a total of 41 studies have been conducted in developed countries and 11 papers from developing countries were included for final extraction of the data (**Figure 3: Health Evidence™ tools: Literature search results**). These studies have been conducted from Countries namely India (1 study), South Africa (2 studies), Turkey (1 study) and Malaysia (5 studies), China (1 study), Brazil (1 studies). One study conducted in Brazil was classified as Level II whereas other studies were of Level V to Level VI study (Study designs were mixed methods, cross-sectional and qualitative studies) (**Appendix6 : Table of Evidence and data Extraction**). The minimal number of participants ranged from 4 participants up to a maximum no of 200 participants. The targeted populations have a mixture of healthy subjects, dementia subjects or caregivers [19].

Types of gerontechnology that have been identified were information communication technology (ICT) namely digital broadcasting (webcasts, teleconference, multimedia), technology assisted communication, health related technology (Virtual reality - Nintendo WiiTM), technology assisted home living were tested in the target population to assess the barrier for usability and acceptability and improving health. Substantial studies also adopted a mixed-methods study design to explore further on the technology utility behavior in order to develop application or prototype that suits older persons' lifestyle [20].

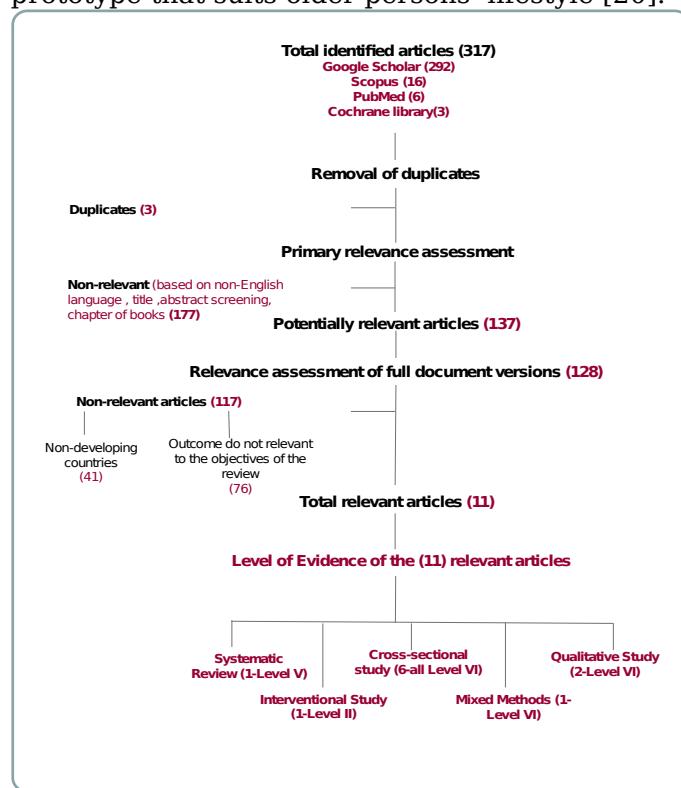


Figure 3: Health Evidence™ tools: Literature search results

Range of the Gerontechnology and Its Acceptability

A total of Three studies [9]; [18]; [20] have assessed the acceptance of the clients based on the Technology Acceptance Model (TAM), 2 out of the 3 studies[9]; [18] have shown low acceptance to the technology usage. From the study done by Jarvis et al, there was high ownership of mobile phones (87.7%) with 19.3% of the home indwellers owned a smartphones. Based on the Senior Technology Acceptance Model (STAM) with younger-old (60-79 years

vs.>80 years old), the overall technology acceptance was good among the studied population. This was indicated by high scoring on perception of good quality of life, perceived the usefulness and the facilitators of the technology has positive effect towards user behavior, it explained 40% to 50 % of the variation [20]. Apart from that high rate of score for better literacy (secondary school and higher vs. primary school and lower) have positive outcomes on the four domains for STAM. Next family support plays an important role in encouraging acceptance of the telecommunication tools. To be able to control their financial resources was another factor that favors the usage of the gadgets. On testing of the STAM education it was seen to have strong relationships towards user's behavior, the model explained 90% of the variation. On the other hand, Hui 2016 has used similar model on assessing a group of younger age group of older persons from the community in Malaysia on the acceptance of smartphones. The results showed positive acceptance of smartphone usage and much higher than other studies done elsewhere. The determinants found were compatibility and perceived enjoyment [18]. This study reported that perceived usefulness was not a significant predictor of behavioral intention of smart phone adoption among the participants and this was in contrast to study done by Jarvis et al. Chipps et al 2017 also conducted another similar study in the Africa region and found that the acceptance to technology were low [9], [21]

Common electronic devices that were observed to be used by the elderly were computers, telecommunication devices (Smartphones, mobile phones and home phones) [9]; [20]; [22] and robotics. Smartphones have emerged as the most frequent devices being tested for its usability and the acceptance by older persons from developing countries. A local study done by Zareei et al has revealed home telephones (HT) were not suitable for older people based on the usability index. From this study a factor analysis was carried out to identify the number of latent factors for mobile phone (MP) and home telephone (HT). The relative weights for the extracted factors were then evaluated by six experts using the GAHP technique. "Adjustability to user needs and abilities" for MP and "ease of operation" for HT was weighted most. A total of ten products including 6 MPs and 4 HTs were assessed by five elderly subjects. The usability index for each MP and HT family of products was then obtained by TOPSIS which was used to select the best product. None of the four common designs of HT complied with the usability factors indicating that the design of current HT products is unsuitable for the elderly, for communication [22], [10]

Barriers and Facilitators

The facilitators of technology usage were driven by socio-demographic background (younger participants (60-74 years), divorced participants and participants with higher educational qualifications) [9], how Interesting or enjoyable to be used, familiarity [5] and the comfort of using the gadget. Older age groups of the older persons remains as the important barrier to the usage of technologies such as smartphones and computers either for communication [9]; [18]; [20] or for work purposes. Both studies by Jarvis et al and Yaacod et al reported that higher level of education promote the usage of technology[23]

Another finding from in-depth interviews is that the theme for barriers to gerontechnology usage among the caregivers were related to the language used, cultural relevance, lack of time, difficulty in accessing the internet, lack of awareness about the portal and difficulty in reaching the rural population [3]. Whereas Imamogullari[19] have highlighted the emotional and behavioral disturbance contributing to low usage of the technology among the formal and informal caregivers [23]

Gerontology and Wellbeing

A very limited quantitative study conducted in developing countries has been done to evaluate the effectiveness of Gerontechnology in improving the quality of life. A qualitative study has been done by Joseph et al to explore the key factor in adopting the Near Field Communication (NFC) home system usage among the Chinese ethnic group in Malaysia. 118 participants have agreed that NFC enhances their quality of life in terms of happiness, independence and convenience. Below is the feedback from the participants [21]:

"Ah... it will help most of the people to live a better life... Like older people, they don't like walking distance to put on the switch. They want a device to be near them so that when they touch it the light is on. They don't have to walk a distance to put on the light"
(RC1014, female, age 69).

"Well it's improvement in lives" (RC3017, male, age 64).

"Huh? Is very good life, very enjoyable" (RC3035, female, age 82)

"Yes, definitely, because you don't have to move around. You could just lie down on the bed and tap and the light would turn on. Then, it becomes very convenient. Normally, when we want to go to bed and I want to read something, I would have to get up to walk and turn on the light so it's a little troublesome. But if I want to check what time is it, all I have to do is tap and I would know the time"
(RC2010, male, age 69).

However the single blinded randomized control trial (RCT) conducted by Pompeu et al. [24] investigated the effect of Nintendo WiiTM-based motor cognitive training versus balance exercise therapy on activities of daily living in patients with Parkinson's disease. Results revealed there were no additional advantages associated with the Wii-based motor and cognitive training[1].

Case Study

A total number of thirty one (n = 31) participants have been recruited from India (n= 20) and Malaysia (n=11) for the current study with the response rate of 100%. The majority of the participants were from the age group of 61 years old to 70 years old (54.8%, n= 17) followed by a younger age group of 50 years old to 60 years old (35.5 , n=11). Male and female were approximately having equal shares of the numbers of participants. Almost all of the participants were urban indwellers (96.8%, n=30) with majority of them were not working (48.4%, n= 15) or working in servicing line (19.4%, n=6). Most of the older adults from these two countries were without any savings (no (61.3%) versus yes (38.7%)). This study also recorded 35.5% (n=11) of the older adults having chronic illness(**Table 1**).

Table 1: Participants Profiles (n= 31)

Participants Profiles	n	% of Total
Age		
50-60	11	35.5 %
61-70	17	54.8 %
71-80	3	9.7 %
Gender		
Male	16	51.6 %
Female	15	48.4 %
Place of Indwelling		
Urban	30	96.8 %
Rural	1	3.2 %
Occupation		
Production	1	3.2 %
Services	6	19.4 %
Own Business	2	6.5 %
Not Working	15	48.4 %
Pension With Salary	3	9.7 %
Pensioner /home makers	4	12.9 %
Retirement Savings		
No	19	61.3 %
Yes	12	38.7 %
Chronic Illness		
No	20	64.5 %
Yes	11	35.5 %

Gerontechnology Usage

Older adults from both countries has opted for telecommunication devices (Mobile phones or smart phones 41.9%, n =13) as the next essential things after the basic needs like shelter, food and transportation. Mobile phones and smart phones have emerged as the most commonly used information communication technology (ICT) devices among the older adults in both countries. Most of the participants also found to have been frequently engaged with their devices with the frequency ranges from more than half the week (41.9 %, n=13) to more than 4 hours of daily usage (45.2%, n= 14). Chatting via Whatapps/ Wechat/Messenger (56.9%, n=25) were the most popular usage of smart phones among the participants(**Table 2**).

Table 2: Gerontechnology Usage (n=31)

Questions	n	% of Total
Apart from basic necessities like shelter, adequate food and transportation, what are other 1 items you need the most?		
TV	9	29.0
Mobile phones/Smart Phones	13	41.9
Internet Connections	3	9.7
Land	2	6.5
Exercise	4	12.9
Which are the devices you have owned currently?		
Mobile phones	6	19.4
Smart phones	25	80.6
Tablets	0	0.0
Laptops	0	0.0
Game station	0	0.0
**Common usages of smartphone		
SMS	2	4.5
Chatting via What Sapp/WeChat/ Messenger/	25	56.9
Email	4	9.1
Browsing Facebook	9	20.5
Watching YouTube	2	4.5
Call	2	4.5
Frequencies of How often you use the above devices?		
Once a week	3	9.7
More than half a week	13	41.9
Daily (>4 hrs.)	14	45.2
Daily (<4 hrs.)	1	3.2
Number of smartphone's functions used		
0	1	3.2
1	18	54.8
2	10	35.5
3	2	6.5

**n = 44

As for the open ended question on *what is your opinion in regards to the usage of smartphones or technology among older adults?* The main final themes that emerged from the thematic analysis were Trend versus Necessity, facilitator and barriers, accessibility and wellbeing the participants(**Table 3**).

Table 3: Table of Thematic Analysis

Participants Feedbacks	Key Themes	Final Theme
It's increasing	Trend	Trend Versus Necessity
Follow trend Productive use We use it only when required Is not necessity	Necessity	
Easy	Facilitator and Barrier	Facilitator and Barrier
Easy Easy communication Must be user friendly Not easy		
I think some older generation still not familiar	Familiarity	
Keeps you connected and updated	Accessible to information	Accessibility for communication and learning
Usage of smartphones or technology among older adults to keep updated about the day to day activities. Information can be collected in a single click. To get the latest information Communication and to get latest information		
A good way to be in touch	Promote connectedness	
It helps me stay connected with everyone and information is shared by the use of technology Essential to connect with family To connect with family friends and most of the bill payments are done online Essential, connect with people, banking A good way to be in touch Facilitating better interpersonal relationships and perceived technology support for administrative tasks and communication, brings a wealth of advantages.	networking	
Senior in the digital age and technology has had a mostly positive impact on society, while roughly three quarters of internet using seniors say they go online including me.		
Technology is getting complicated but we need to keep updating ourselves People should be using smartphones in order to increase their knowledge according to newer technologies Need to learn new technology Need to learn	Promote self-learning	

Useful in emergency	Security	Wellbeing
Technological advances that can directly the elderly and help promote aging in place include remote sensors and blood pressure etc.	Promote wellbeing	
The technology use would be associated with better health and well being		
Interesting to spent time	leisure	

DISCUSSION

Technology Acceptance Model (TAM) has been introduced by Dr Davis in 1989. It is a well-known theory explaining user acceptance and behavior related to new technologies. Part of this model was as results of adaptation from theory of Reasoned Action (TRA). Results from this review showed, the acceptance of gerontechnology among the older persons among older persons in the developing countries noted to be low in countries like South Africa but not so much towards countries like Malaysia. This may attribute to the variation in information technology development among different countries. Malaysia has experienced the rapid growth of ICT owing to Malaysia Plan, since 7th National Plan in 1996 till the latest 9th National Plan. The country has recognized that in the Information Era, ICT adoption facilitate competition in the global economy productivity and efficiency, that enable the enhancement of quality of life. Despite that, none of the countries could avoid factors that lead to digital divides. From the studies done by Jarvis et al and Hui, this could be explained by both determinants of technology acceptance, perceived usefulness and perceived ease of use of technology may be influenced by cultural and demographic factors, and physical limitations such as deficits in dexterity, sight and hearing[6].

Age still remain the gaps for technology utilization among the older persons. Apart from the physical and cognitive deprivation, one can be explained by the term "Technology generations" has explain the distinct characteristic of each generation in adopting the technology. Generation X (Born 1965 to 1976)- primarily utilize email and telephone to communicate, while generation Z, iGen, or Centennials (Born 1996 and later) - primarily utilize handheld communication devices and accessories to communicate. In fact, they're on messaging apps 57% of the time they're using their smartphones. Age gaps also can be explained, this phenomenon can be explained by the Socioemotional Selectivity Theory. This theory suggests that people prioritize their goals relative to their age and perception of time. Young people see time as open-ended. With increasing age, older adults view their future as limited and they do not have "all the time in the world" left to pursue their goals. Hence, they use their time and energy selectively [8].

Higher Education attainment has proven as a facilitator for digital usage such as smartphones and computers. This can be explained by the fact that the awareness of the usefulness of the tool is influenced by the past working experience which required them to use the technology. Since the level of literacy could promote the usage, it is useful to create awareness of the usage via dedicated training sessions for the older persons. This benefit of training in ICT has been proven in developed countries. The training that focus on promoting communication and searching for information abilities stimulate the older persons to develop interest in seeking information that could benefit their wellbeing [23], [24].

The high accessibility to information and communication enabling tools reflected by a high ownership mobile phones, smartphones, tablets, computers and so on [9]; [18]; [20]. Smartphones emerged as the most popular gadget as per the capabilities and convenience of participants. Apart from that, its ability of going online allow social connectivity Facebook, WhatsApp, WeChat, sharing photos via Instagram and so on are getting good response from the older generation. Maintaining social connectedness is the key solution for older person's social isolation and improving mental wellbeing. However, the downside of smartphone is its small size screen which makes reading difficult by the senior citizen [14].

Ultimately the aim of adoption of the technology is to enhance wellbeing of the older persons. A qualitative study done by Joseph et al has shed some light on the agreement of the studied subjects regarding impact of the technology-assisted home living on their wellbeing. This has been supported by another study done by Jarvis et al who opined that one reason to use the technology is the perception of health benefits of using it. However, there is a need to reiterate that the limited evidence in developing countries have led to the limitation of making a sound conclusion.

Therefore the authors have undertaken another case study, recruiting participants from India and Malaysia to gather preliminary information on the gerontechnology usage profiling. Despite having no savings and retirement fund, the older persons in these countries have high ownership of the ICT devices reflecting the affordability of the technology. Another important finding from this survey was, 35.5% of the participants who owned ICT devices had chronic illnesses, though this proportion is higher than the prevalence of chronic illnesses in these countries, it is adequate to shed light on the high accessibility of the device among the older persons who has co-morbidity. In addition, the last open ended question has confirmed the Socio-emotional Selectivity Theory (use when necessary), wellbeing, the ease of usage for communication and access for information's are reasons for usage [25].

Limitations

The review showed evidence for gerontechnology in the developing countries is scarce and fragmented. Most of the studies were of low quality with small sample size and unclear methodology. None of the studies have utilized standardized measurement tools i.e. WHO quality of Life questionnaires and SF-12 to assess the primary outcome of the study. This has contributes to the difficulty in data synthesis for making a sound conclusion [13].

The review also shows that there are still few data on the efficacy and effectiveness, most of which were reports about the feasibility of various applications, and only a few of the studies reported a controlled comparison of a telemedicine application with conventional means of providing services. The feasibility study conducted in this review is a purposive sampling study and hence the interpretation has to be cautioned [2].

CONCLUSION

In closing, more work should be done for India and Malaysia Concentrate on two points viz. optimization of Software and nature of the goods and services, to fit the needs of the aged of India and Malaysia.

The lack of usage and acceptability of gerontechnology in developed nations and the distrust of the elderly for face-development products, are big problems considering the simplicity of use of a product and its usefulness. Nonetheless, older persons may not be engaged in technology for three reasons: firstly, their own personal conditions, such as lack of expertise and physical weakness, may obstruct their willingness to use technology; secondly, technical obstacles such as expense and sophistication inhibit their usage; thirdly, the social environment, including lack of assistance and restricted access to modern technology[17].

Impact of Gerontechnology on the quality of life areas includes physical, psychological, social or climate. The analysis of the research practices presented in this essay should be seen as a basis of knowledge, as there is no well-defined repository of publications, covering most of the papers that have been published.

In Malaysia and India, the use of gerontechnology by older adults has strong correlations with age, gender, education, Economic status, self-efficacy and anxiety in gerontechnology, circumstances encouraging, and features of safety and capacity.

In describing the actions of older adults through the usage of technology, the present research went beyond previous Gerontechnology and Older Persons Welfare through developing countries by taking into account age-related health and skill variables, such as self-reported health problems, functional skills, cognitive Skills and changing mentality and overall satisfaction.

Another aspect is to give full support to efforts to make gerontechnology accessible to older Indian or Malaysian and within reach. The government will set in effect strategies to allow older citizens to utilize technology, and promote a positive environment that will make them utilize gerontechnology.

Cyber-attacks from gerontechnology

Professional ethics in gerontechnology highlight cyber-attacks from gerontechnology may impact on the health and wellbeing of older people. Learn to learn the fundamentals about device and internet protection and urge family members to teach their older relatives. Do not exchange sensitive details over the mobile or email. Have machines and the internet tested and monitored regularly for malware. Visit websites that are recognized and trustworthy and avoid new websites that might have services that collect sensitive details without permission. Be suspicious, so press carefully. Should not accept e-mails from anonymous senders. Using caller I'd telephones and speak to recognized persons only. Should not allow voluntary donations by phone. Learn to learn the fundamentals about information technology and the Internet, and inspire family members to teach their older relatives. Exit Digital Shopping. Do not reveal personal details over the mobile or online.

The first step is education; the second step is to disclose such offenses as they arise occurrence, and the law enforcement will deal with the issue. Last but not least, as in any type of violence or manipulation, there is usually more than one negative consequence. Apart from the financial damage caused by cybercrimes, cybercrime victims can suffer psychological trauma and the consequent fear of using technology. Dealing with the social effect and finding preventive steps will be part of the attention of health care practitioners. Nurses should partner alongside other professionals to help alleviate mental distress and support the quality of life of older people [4].

The delivery of comprehensive treatment to older people needs consideration of the human, mental, social, sociological and financial standing. Data obtained from this review was used to advise treatment arrangements for older people. If some kind of financial fraud, including cybercrime, is reported, nurses have a professional and ethical duty to disclose these results to local stakeholders. This will help nurses defend elderly adults who are threatened by cybercriminals.

RECOMMENDATIONS

Future studies should try to include self-assessment of health and abilities characteristics, together with performance-based functioning tests in understanding of users' interactions with products and technology.

Barriers and facilitators are connected with the adoption of Gerontechnology. The recommendations adopted involve promoting creativity from a strength-based viewpoint, focusing on available technological tools to improve wellbeing, by creating a social support network to assist in the usage of digital technologies, and discussing further how inter-generational relationships may be improved by the use of digital technologies.

In addition to the theoretical consequences set out above, a list of concrete guidelines can be extracted from this literature review. In particular, the following points should be considered when applying a participatory research or design approach in the field of gerontechnology: researchers and designers need to wonder why participatory methods should be included, who is going to be targeted as an audience, how and when future users may be involved. Depending on the answers to these queries, the sampling process, the methodology and the degree of participation have to be changed. The effects and/or the method, too, should be analyzed[22].

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

ACKNOWLEDGEMENT

Firstly I would like to give all thanks to God for granting me the grace to complete this research. I would like to extend my greatest gratitude to my Supervisors Dr. Prof Noran N Hairi Professor from the Department of Social and Preventive Medicine, Faculty of Medicine, University Malaya for their guidance and inspiration in completing this research.

I would like to convey my deepest appreciation to all the lecturers from the Department of Social and Preventive Medicine, University Malaya who had dedicated their precious time in guiding me throughout the journey. I would like to extend a special thanks to all my friends their endless support and assistance in the development of this research.

Last but not the least, this acknowledgement is incomplete if I fail in my duty to thank all my study subjects who have whole-heartedly participated in the study and have made the study complete.

Lastly, I would like to thank my family for their love, patience and support during the development of this research.

REFERENCES

1. NIH. (2015). Meeting Advances Alzheimer's Research Agenda. *Global Health Matters Newsletter*, 14(2).
2. United Nations, D. o. E. a. S. A., Population Division (2019). *World Population Ageing 2019: Highlights*. Retrieved from
3. Baruah, U., Shivakumar, P., Loganathan, S., Pot, A. M., Mehta, K. M., Gallagher-Thompson, D., . . . Varghese, M. (2020). Perspectives on Components of an Online Training and Support Program for Dementia Family Caregivers in India: A Focus Group Study. *ClinGerontol*, 1-15. doi:10.1080/07317115.2020.1725703
4. WHO. (2011). *Global Health & Aging*. (Cited on 01/06/2020) Retrieved from https://www.who.int/ageing/publications/global_health.pdf
5. Bidin, S. A. H., Lokman, A. M., Mohd, W. A. R. W., & Tsuchiya, T. (2017). *Initial Intervention Study of Kansei Robotic Implementation for Elderly*. Paper presented at the IEEE International Symposium on Robotics and Intelligent Sensors, IRIS 2016.
6. Organization, W. H. (2015). *World report on ageing and health*: World Health Organization.
7. Bronswijk, J. E., Bouma, H., Fozard, J. L., Kearns, W. D., Davison, G. C., & Tuan, P.-C. J. G. (2009). Defining gerontechnology for R&D purposes. *8*(1), 3.
8. Organization, W. H. (2017). Global strategy and action plan on ageing and health.
9. Chipps, J., & Jarvis, M. A. J. I. D. (2017). Technology-assisted communication in older persons in a residential care facility in South Africa. *33*(4), 393-405.
10. Kwon, S. (2017). *Gerontechnology: Research, Practice, And Principles In The Field Of Technology And Aging*: Springer Publishing.
11. Halicka, K. (2019). Gerontechnology — the assessment of one selected technology improving the quality of life of older adults. *11*(2), 43. (Cited on 01/05/2020) Available from doi:<https://doi.org/10.2478/emj-2019-0010>
12. De la Torre, F., Morales, D., & Quiroz, C. P. (2015). Gerontechnology: rapid review and global trends. *Mexican Journal of Biomedical Engineering*, 36(3), 171-179. doi:10.17488/RMIB.36.3.3
13. Schulz, R., Wahl, H.-W., Matthews, J. T., De Vito Dabbs, A., Beach, S. R., & Czaja, S. J. (2015). Advancing the Aging and Technology Agenda in Gerontology. *Gerontologist*, 55(5), 724-734. doi:10.1093/geront/gnu071
14. Hailey, D., Roine, R., & Ohinmaa, A. (2002). Systematic review of evidence for the benefits of telemedicine. *J Telemed Telecare*, 8 Suppl 1, 1-30. doi:10.1258/1357633021937604
15. Roine, R., Ohinmaa, A., & Hailey, D. (2001). Assessing telemedicine: a systematic review of the literature. *Cmaj*, 165(6), 765-771. Retrieved from (Cited on 18/05/2020) Available from <https://pubmed.ncbi.nlm.nih.gov/11584564>
16. Hooper, R. J. L., England: National Institute for Health Research. (2019). Justifying sample size for a feasibility study.
17. Viechtbauer, W., Smits, L., Kotz, D., Budé, L., Spigt, M., Serroyen, J., & Crutzen, R. (2015). A simple formula for the calculation of sample size in pilot studies. *Journal of Clinical Epidemiology*, 68(11), 1375-1379. (Cited on 25/05/2020) Available Form doi:<https://doi.org/10.1016/j.jclinepi.2015.04.014>

18. Hui, K. Y. (2016). *Determinants of Smartphone Adoption among Older Adults in Malaysia*. UTAR,

19. Imamogullari, B. J. P. d. p. P. t. o. D. a. w. d. i. P. (2017). Designing for Therapies in Dementia: ICT-Enabled Design Practice for Supporting Nonpharmacological Therapies in Alzheimer's. 170.

20. Jarvis, M.-A., Sartorius, B., & Chipps, J. (2019). Technology acceptance of older persons living in residential care. *J Information Development*, 0266666919854164.

21. Joseph, S., Teh, P. L., Chan, A. H. S., Ahmed, P. K., Cheong, S. N., & Yap, W. J. (2016). Gerontechnology usage and acceptance model (GUAM): A qualitative study of Chinese older adults in Malaysia. *Gerontechnology*, 14(4), 224-238. doi:10.4017/gt.2016.14.4.005.00 10.1016/j.apergo.2015.11.015;

22. Zareei, H., Yusuff, R. M., Salit, S. M., Sar, S. N., & Mohd, R. H. J. U. A. i. t. I. S. (2017). Assessing the usability and ergonomic considerations on communication technology for older Malaysians. 16(2), 425-43.

23. Nguyen, T. T. H., Tapanainen, T., & Obi, T. (2014). *A Review of Information and Communication Technology (ICT) Training for Elderly People-toward Recommendations for Developing Countries*. Paper presented at the PACIS.

24. Pompeu, J. E., Mendes, F. A., Silva, K. G., Lobo, A. M., Oliveira Tde, P., Zomignani, A. P., & Piemonte, M. E. (2012). Effect of Nintendo Wii™-based motor and cognitive training on activities of daily living in patients with Parkinson's disease: a randomised clinical trial. *Physiotherapy*, 98(3), 196-204. doi:10.1016/j.physio.2012.06.004

25. National Center for Biotechnology Information, U.S. National Library of Medicine (Cited on 18/05/2020)
Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC81454/>